

Mark Scheme (Results)

November 2013

Pearson Edexcel GCSE
Linked Pair Pilot in Mathematics
Methods in Mathematics (2MM01)
Higher Paper 1H

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NOTES ON MARKING PRINCIPLES

- 1** All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- 2** Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- 3** All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- 4** Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- 5** Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.
- 6** Mark schemes will indicate within the table where, and which strands of QWC, are being assessed. The strands are as follows:
 - i) *ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear*
Comprehension and meaning is clear by using correct notation and labeling conventions.
 - ii) *select and use a form and style of writing appropriate to purpose and to complex subject matter*
Reasoning, explanation or argument is correct and appropriately structured to convey mathematical reasoning.
 - iii) *organise information clearly and coherently, using specialist vocabulary when appropriate.*
The mathematical methods and processes used are coherently and clearly organised and the appropriate mathematical vocabulary used.

7 With working

If there is a wrong answer indicated on the answer line always check the working in the body of the script (and on any diagrams), and award any marks appropriate from the mark scheme.

If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.

If it is clear from the working that the "correct" answer has been obtained from incorrect working, award 0 marks. Send the response to review, and discuss each of these situations with your Team Leader.

If there is no answer on the answer line then check the working for an obvious answer.

Any case of suspected misread loses A (and B) marks on that part, but can gain the M marks. Discuss each of these situations with your Team Leader.

If there is a choice of methods shown, then no marks should be awarded, unless the answer on the answer line makes clear the method that has been used.

8 Follow through marks

Follow through marks which involve a single stage calculation can be awarded without working since you can check the answer yourself, but if ambiguous do not award.

Follow through marks which involve more than one stage of calculation can only be awarded on sight of the relevant working, even if it appears obvious that there is only one way you could get the answer given.

9 Ignoring subsequent work

It is appropriate to ignore subsequent work when the additional work does not change the answer in a way that is inappropriate for the question: e.g. incorrect canceling of a fraction that would otherwise be correct

It is not appropriate to ignore subsequent work when the additional work essentially makes the answer incorrect e.g. algebra.

Transcription errors occur when candidates present a correct answer in working, and write it incorrectly on the answer line; mark the correct answer.

10 Probability

Probability answers must be given as fractions, percentages or decimals. If a candidate gives a decimal equivalent to a probability, this should be written to at least 2 decimal places (unless tenths).

Incorrect notation should lose the accuracy marks, but be awarded any implied method marks.

If a probability answer is given on the answer line using both incorrect and correct notation, award the marks.

If a probability fraction is given then cancelled incorrectly, ignore the incorrectly cancelled answer.

11 Linear equations

Full marks can be gained if the solution alone is given on the answer line, or otherwise unambiguously indicated in working (without contradiction elsewhere). Where the correct solution only is shown substituted, but not identified as the solution, the accuracy mark is lost but any method marks can be awarded.

12 Parts of questions

Unless allowed by the mark scheme, the marks allocated to one part of the question CANNOT be awarded in another.

13 Range of answers

Unless otherwise stated, when an answer is given as a range (e.g 3.5 – 4.2) then this is inclusive of the end points (e.g 3.5, 4.2) and includes all numbers within the range (e.g 4, 4.1)

Guidance on the use of codes within this mark scheme

M1 – method mark
A1 – accuracy mark
B1 – Working mark
C1 – communication mark
QWC – quality of written communication
oe – or equivalent
cao – correct answer only
ft – follow through
sc – special case
dep – dependent (on a previous mark or conclusion)
indep – independent
isw – ignore subsequent working

PAPER: 5MM1H_01					
Question		Working	Answer	Mark	Notes
1	(i)		3179000	1	B1 cao
	(ii)		317.9(0)	1	B1
	(iii)		37400	1	B1 cao
2	(a)		$\frac{3}{7}$	1	B1 for $\frac{3}{7}$ oe
	(b)	$\frac{3}{9} + \frac{2}{9}$	$\frac{5}{9}$	1	B1 for $\frac{5}{9}$ oe

PAPER: 5MM1H_01					
Question		Working	Answer	Mark	Notes
3			78	4	<p>M1 for a correct method to find the area of a relevant rectangle.</p> <p>M1 for a correct method to find the area of a relevant triangle</p> <p>M1 for a complete and correct method to find the total area</p> <p>A1 cao</p> <p>Or</p> <p>M2 for splitting the shape into two trapeziums and using a correct method to find the area of the trapezium</p> <p>M1 for 2 x 'area of trapezium'</p> <p>A1 cao</p>

PAPER: 5MM1H_01																				
Question		Working				Answer	Mark	Notes												
4		<table><tr><td>-1</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>9</td><td>7</td><td>5</td><td>3</td><td>1</td><td>-1</td></tr></table>				-1	0	1	2	3	4	9	7	5	3	1	-1	correct line drawn	3	<p>(Table of values) M1 for at least 2 correct attempts to find points by substituting values of x. M1 ft for plotting at least 2 of their points (any points plotted from their table must be correct) A1 for correct line between -1 and 4</p> <p>(No table of values) M2 for at least 2 correct points (and no incorrect points) plotted OR line segment of $y = 7 - 2x$ drawn (ignore any additional incorrect segments) (M1 for at least 3 correct points with no more than 2 incorrect points) A1 for correct line between -1 and 4</p> <p>(Use of $y=mx+c$) M2 line segment of $y = 7 - 2x$ drawn (ignore any additional incorrect segments) (M1 for line drawn with gradient of -2 OR line drawn with a y intercept of 7 and a negative gradient) A1 for correct line between -1 and 4</p>
-1	0	1	2	3	4															
9	7	5	3	1	-1															
5		$\frac{200}{0.5}$				400	2	<p>M1 for rounding to 200 or 0.5 A1 cao</p>												

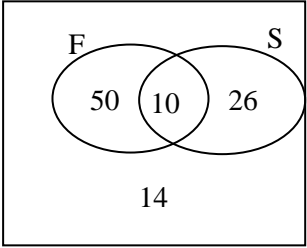
PAPER: 5MM1H_01					
Question		Working	Answer	Mark	Notes
6			$\frac{8}{12}$	2	M1 for $\frac{x}{12}, x \neq 8, x < 12$ or $\frac{8}{x}, x \neq 12, x > 8$ A1 for $\frac{8}{12}$ oe
7	(a)	$\begin{array}{r} 2 \overline{)220} \\ 2 \overline{)110} \\ 5 \overline{)55} \\ \underline{11} \end{array}$	$2^2 \times 5 \times 11$	2	M1 for a systematic method of at least two correct divisions by a prime number or 2 correct division stages on a factor tree or a full process with one calculation error A1 for $2 \times 2 \times 5 \times 11$ or $2^2 \times 5 \times 11$
	(b)	<p>165, 330, 495, 660 220, 440, 660</p> <p>$220 = 2^2 \times 5 \times 11$ $165 = 3 \times 5 \times 11$ $2^2 \times 5 \times 11 \times 3$</p>	660	2	M1 for listing multiples, at least 3 of each, condone one addition error 165, 330, 495, 660 220, 440, 660 A1 cao or M1 for $3 \times 5 \times 11$ and $2^2 \times 5 \times 11$ (accept $4 \times 5 \times 11$) Could be seen in part a. A1 cao
8		$\begin{array}{l} 7x + 2 = 3x - 12 \\ 7x - 3x = -12 - 2 \\ 4x = -14 \\ \frac{-14}{4} \\ x = \frac{-14}{4} \end{array}$	$\frac{-7}{2}$	3	M1 for $3 \times x - 3 \times 4$ oe or $\frac{7x+2}{3}$ oe M1(dep) for correct method to isolate terms in x or numbers on one side of the equation A1 for $\frac{-7}{2}$ oe

PAPER: 5MM1H_01																			
Question		Working	Answer	Mark	Notes														
9	(a)		reflection in $x = 5$	2	B1 for reflection B1 for $x = 5$														
	(b)		rectangle with vertices (1, 3),(1, 6), (7, 6), (7, 3)	2	M1 for enlargement sf 3 A1 for fully correct answer														
	(c)		90° clockwise, centre (0, 0)	3	B2 90° clockwise or 270° anticlockwise (B1 90° or 270° stated without direction or with incorrect direction or correct translation of S shown) B1 centre (0,0)														
10	(i)	$(\frac{1}{3} \times \frac{1}{3}) + (\frac{1}{3} \times \frac{1}{3})$	$\frac{2}{9}$	5	M1 for identifying there are 9 possible outcomes or $(\frac{1}{3} \times \frac{1}{3})$ M1 for clearly identifying the two outcomes (1, 6) and (3, 2) or $(\frac{1}{3} \times \frac{1}{3}) + (\frac{1}{3} \times \frac{1}{3})$ A1 for $\frac{2}{9}$ oe														
	(ii)	<table><tr><td>×</td><td>1</td><td>3</td><td>5</td></tr><tr><td>2</td><td>2</td><td>6</td><td>10</td></tr><tr><td>4</td><td>4</td><td>12</td><td>20</td></tr><tr><td>6</td><td>6</td><td>18</td><td>30</td></tr></table>	×		1	3	5	2	2	6	10	4	4	12	20	6	6	18	30
×	1	3	5																
2	2	6	10																
4	4	12	20																
6	6	18	30																

PAPER: 5MM1H_01					
Question		Working	Answer	Mark	Notes
11		$\frac{0+5}{2}, \frac{3+0}{2}, \frac{2+2}{2}$	(2.5, 1.5, 2)	3	B1 2.5 B1 1.5 B1 2 (SCB1 if no previous mark awarded, for A (0,3,2) or B (5,0,2))
12	(a)	$x^2 - 6x + x - 6$	a^3	1	B1 cao
	(b)		b^4	1	B1 cao
	(c)		c^{12}	1	B1 cao
	(d)		$11x^2 + 18$	2	M1 for correct expansion of one bracket $5x^2 + 10$ or $6x^2 + 8$ A1 cao
	(e)		$x^2 - 5x - 6$	2	M1 for 4 terms correct with or without signs or 3 out of exactly 4 fully terms correct (the terms may be in an expression or table) A1 cao

PAPER: 5MM1H_01														
Question		Working	Answer	Mark	Notes									
13	(a)	$\frac{8}{20} + \frac{5}{20}$ <table border="1"><tr><td></td><td>2</td><td>5</td></tr><tr><td>1</td><td></td><td>5</td></tr><tr><td>4</td><td>8</td><td>20</td></tr></table>		2	5	1		5	4	8	20	$\frac{13}{20}$	2	M1 for both fractions expressed with a suitable common denominator (multiple of 20) and at least one of the two fractions correct A1 for $\frac{13}{20}$ oe or M1 for 0.4 + 0.25 A1 for 0.65 or M1 for table structure, all cells correct A1 for $\frac{13}{20}$ oe
	2	5												
1		5												
4	8	20												
	(b)	$\frac{25}{8} \times \frac{12}{5}$	$\frac{15}{2}$	3	M1 for a correct method to convert to improper fractions eg $\frac{3 \times 8 + 1}{8}$ or _____ M1 (dep) for _____ A1 for $\frac{15}{2}$ or $7\frac{1}{2}$ (SCB2 for 7.5)									

PAPER: 5MM1H_01					
Question		Working	Answer	Mark	Notes
14	(a)	$4^2 + 3 \times 4 - 2$	26	2	M1 for substituting 4 into the expression eg $4^2 + 3 \times 4 - 2$ A1 cao
	(b)	$ \begin{array}{ccccc} 1 & 7 & 17 & 31 & 49 \\ & 6 & 10 & 14 & 18 \\ & & 4 & 4 & 4 \end{array} $ $2n^2 + c$	$2n^2 - 1$	3	M1 for correct method to find second differences M1(dep) for $2n^2 + bn + c$ A1 for $2n^2 - 1$ or M1 for identifying general expression, n th term = $an^2 + bn + c$ M1 for 3 equations in a, b, c , $a \times 1^2 + b \times 1 + c = 1$ $a \times 2^2 + b \times 2 + c = 7$ $a \times 3^2 + b \times 3 + c = 17$ A1 for $2n^2 - 1$ Or M1 for listing the first 5 square numbers M1 for doubling the first five square numbers A1 for $2n^2 - 1$
15	(a)		740000	1	B1 cao
	(b)		3.5×10^{-7}	1	B1 cao
	(c)	$\frac{4}{8} \times 10^{-6-5}$ 0.5×10^{-11}	5×10^{-12}	2	M1 for $\frac{4}{8} \times 10^{-6-5}$ or $a \times 10^{-11}$ or $5 \times 10^b, b \neq -12$ or 0.000000000005 A1 cao

Paper 5MM1H_01					
Question		Working	Answer	Mark	Notes
16	(a)		$5x(2x + 1)$	2	B2 $5x(2x + 1)$ (B1 for $x(10x + 5)$ or $5(2x^2 + x)$ or $(5x + 0)(2x + 1)$)
	(b)		$(x - 3)(x - 4)$	2	M1 for $(x \pm 3)(x \pm 4)$ A1 for $(x - 3)(x - 4)$
17	(a)	$100 - 14 = 86$ $60 + 36 - 86 = 10$ $60 - 10 = 50$ $36 - 10 = 26$		4	M1 for two overlapping labelled circles B1 for 14 shown outside the circles M1 for 60-‘10’ or 36-‘10’ (‘10’≠0) A1 for a fully correct and labelled Venn diagram (condone omission of surrounding rectangle)
	(b)	$\frac{100 - 14}{100}$	$\frac{86}{100}$	2	M1 for ‘50’ + ‘10’ + ‘26’ or $100 - ‘14’$ A1 ft —

PAPER: 5MM1H_01					
Question		Working	Answer	Mark	Notes
18		90 – 32	58° with reasons	4	<p>M1 for angle $CDA = 90 - 32$ or $180-90-32$ A1 for ABD is 58 C2 for complete reasons ('the <u>tangent</u> to a circle is <u>perpendicular</u> (90°) to the <u>radius</u> (<u>diameter</u>)' and '<u>Alternate segment</u> theorem') and degrees sign (C1 for one reason)</p> <p>or</p> <p>M1 for angle $AOD = 180 - 2 \times 32$ A1 for ABD is 58 C2 for complete reasons (<u>angles</u> in an <u>isosceles triangle</u> are <u>equal</u>, <u>angles</u> in a <u>triangle</u> add up to <u>180°</u> and <u>Angle</u> at <u>centre</u> is <u>twice angle</u> at <u>circumference</u>) and degrees sign (C1 for <u>Angle</u> at <u>centre</u> is <u>twice angle</u> at <u>circumference</u>)</p>
19	(a)		$\frac{5}{8}, \frac{5}{7}$ and $\frac{4}{7}$	2	<p>B2 for $\frac{5}{8}, \frac{5}{7}$ and $\frac{4}{7}$ in correct positions (B1 for 1 or 2 in correct positions)</p>
	(b)	$\frac{3}{8} \times \frac{2}{7}$	$\frac{6}{56}$	2	<p>M1 for $\frac{3}{8} \times \frac{2}{7}$ A1 for $\frac{6}{56}$ oe</p>

PAPER: 5MM1H_01					
Question		Working	Answer	Mark	Notes
20	(a)	$\frac{1}{2} = 2^{-1}$ $\frac{1}{\sqrt{2}} = 2^{-0.5}$ $\sqrt{2} = 2^{0.5}$	$2^{-2}, \frac{1}{2}, \frac{1}{\sqrt{2}}, 2^0, \sqrt{2}$	2	M1 for changing to powers of 2, eg sight of $2^{0.5}$ or 2^{-1} or $2^{-0.5}$ A1 for correct order (accept alternative equivalent forms eg all powers of 2) (SCB1 if M0 scored, for all in correct reverse order)
20 (con t)	(b)	$\frac{2}{\sqrt{2}} \times \frac{2}{\sqrt{2}} \times \frac{2}{\sqrt{2}} = \frac{8}{2\sqrt{2}}$ $\frac{8}{2\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}}$ $\frac{8\sqrt{2}}{4}$	$2\sqrt{2}$	3	M1 for cubing eg $\frac{2}{\sqrt{2}} \times \frac{2}{\sqrt{2}} \times \frac{2}{\sqrt{2}} (= \frac{8}{2\sqrt{2}})$ M1 for a correct method to rationalise eg $\frac{8}{2\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}}$ or $\frac{2}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}}$ A1 for $2\sqrt{2}$ (accept $a=2$) or M1 for $\frac{2}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} (= \sqrt{2})$ oe M1 for $(\sqrt{2})^3$ A1 for $2\sqrt{2}$ (accept $a=2$)

Question		Working	Answer	Mark	Notes
*21		$ABE = \text{angle } CBD$ (vertically opposite angles) $\text{angle } EAB = \text{angle } CDB$ (alternate angles) $\text{angle } AEB = \text{angle } BCD$ (alternate angles) Or $\text{angle } EAB = \text{angle } CDB$ (alternate angles) $\text{angle } AEB = \text{angle } BCD$ (alternate angles) $ABE = \text{angle } CBD$ (<u>angles</u> in a <u>triangle</u> sum to <u>180°</u>)	proof	4	M1 for any 2 pairs of angles correctly matched A1 for all 3 pairs correctly matched C2 (dep on M1) for full reasons and concluding statement (C1(dep on M1) for at least one reason)
22	(a)	$1 - \frac{1}{4}$	$\frac{3}{4}$	1	B1 for $\frac{3}{4}$ oe
	(b)	$\frac{3}{5} \times \frac{3}{4}$	$\frac{9}{20}$	2	M1 for $\frac{3}{5} \times \frac{3}{4}$, A1 for $\frac{9}{20}$ oe or ft from (a)

PAPER: 5MM1H_01				
Question	Working	Answer	Mark	Notes
*23	$\left[\frac{2n+2n+2}{2} \right]^2$ $= (2n+1)^2 = 4n^2+4n+1$ $\frac{(2n)^2 + (2n+2)^2}{2}$ $= \frac{8n^2 + 8n + 4}{2}$ $= 4n^2+4n+2$ $\frac{a^2 + b^2}{2} - \frac{a^2 + 2ab + b^2}{4}$ $\frac{a^2 - 2ab + b^2}{4}$ $\left[\frac{b-a}{2} \right]^2$	Proof	5	<p>M1 for expressions for 2 consecutive even numbers, eg $2n, 2n+2$</p> <p>M1 for $\left[\frac{'2n'+2n+2'}{2} \right]^2$</p> <p>M1 for $\frac{('2n')^2 + ('2n+2')^2}{2}$</p> <p>A1 for $4n^2+4n+1$ or for $4n^2+4n+2$ oe</p> <p>C1 for $4n^2+4n+1$oe and $4n^2+4n+2$ oe and correct conclusion from correct working</p> <p>or</p> <p>M1 for realisation that $b-a=2$ (or $a-b=-2$)</p> <p>M1 for correct method to expand $\left[\frac{a+b}{2} \right]^2 (=$</p> $\frac{a^2 + 2ab + b^2}{4})$ <p>M1 for $\frac{a^2 + b^2}{2} - \frac{a^2 + 2ab + b^2}{4}$,</p> <p>A1 for $\frac{a^2 - 2ab + b^2}{4}$</p> <p>C1 for $\left[\frac{b-a}{2} \right]^2$ oe and correct conclusion from correct working</p>

PAPER: 5MM1H_01					
Question		Working	Answer	Mark	Notes
24	(a)(i)	$\vec{BP} = \frac{1}{2} \vec{BC}$	$\frac{1}{2}$	2	B1 for $\frac{1}{2}$ oe
	(ii)	$\vec{BD} = \quad -$	$-$		B1 for $-$ oe
	(b)(i)	$\vec{AB} + \vec{BP}$	$+\frac{1}{2}$	3	B1 for $+\frac{1}{2}$ oe
	(ii)	$\vec{AB} + \vec{BQ}$ $+\frac{1}{3}(\quad - \quad)$	$+\frac{1}{3}(\quad - \quad)$		M1 for $\vec{AB} + \vec{BQ}$ or $\vec{AB} + -$ A1 for $+\frac{1}{3}(\quad - \quad) (= \frac{2}{3} + \frac{1}{3})$ oe
	(c)	$AQ = \frac{2}{3} + \frac{1}{3}$	Q is on AP $AQ:QP=2:1$	1	B1 for Q lies on the line AP or for $AQ = \frac{2}{3} AP$ oe

Ofqual



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